



# Oregon

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*Also Sent Via E-mail*

Mr. Robert J. Wyatt  
NW Natural  
220 N.W. Second Avenue  
Portland, OR 97209

**Re: Draft Groundwater Source Control Measures Final Design Report  
Shoreline Segments 1 and 2, NW Natural Property and the Northern Portion of the Siltronic Corporation Property  
Portland, Oregon  
ECSI Nos. 84 and 183**

Dear Mr. Wyatt:

The Department of Environmental Quality (DEQ) reviewed the “Draft Groundwater Source Control Final Design Report, NW Natural Gasco Site” dated May 2011 and received May 9, 2011 (Draft Groundwater SCMs Design). The Draft Groundwater SCMs Design proposes designs for groundwater source control measures (SCMs) along the shoreline of the property owned by NW Natural (NW Natural Property) and the northern portion of the property owned by Siltronic Corporation (Siltronic Property). In addition to the Draft Groundwater SCMs Design, DEQ reviewed the Segment 2 Field Test Report<sup>1</sup>. The Segment 2 Field Test Report presents the results of conducting a series of aquifer tests using pilot extraction wells located along the northern portion of the NW Natural Property shoreline. DEQ’s comments to the Segment 2 Field Test Report are incorporated into this letter. Anchor QEA, LLC prepared the Draft Groundwater SCMs Design and the Segment 2 Field Test Report on behalf of NW Natural.

The Draft Groundwater SCMs Design was prepared after NW Natural and DEQ resolved the dispute over the portion of shoreline Segment 1 where dense non-aqueous phase liquid (DNAPL) occurs, and following a meeting on February 3, 2011. During the February 3<sup>rd</sup> meeting, NW Natural and DEQ discussed key issues and the path forward for source control design, including preparation of the next design document. During the meeting and in subsequent e-mail correspondence DEQ let NW Natural know the next design submittal should be considered another version of the interim source control design document. Although DEQ acknowledged the next design submittal was going to propose designs for the elements needed for groundwater source control, the information, data evaluations, and modeling used to support the Fill water-bearing zone (WBZ) interceptor trench design and Segment 1 hydraulic control and containment (HC&C) system redesign were going to be presented for the first time. Consistent with the established source control planning and design process, providing the initial designs for SCMs was the intended purpose of the interim design document. Based on DEQ’s review of the document, and consistent with meeting discussions and correspondence, DEQ considers the Draft Groundwater SCMs Design to be the equivalent of a Revised Interim Design Report.

The primary purpose of this letter is to inform NW Natural that DEQ:

- Acknowledges the principal elements of groundwater source control are presented in the document, including SCMs designs for the Fill WBZ and Alluvium WBZ;
- Accepts the Draft Groundwater SCMs Design as the Revised Interim Design Report;

<sup>1</sup> Anchor QEA, LLC, 2011, “Segment 2 Capture Zone Field Test Report – Gasco Sediments Site, Portland, Oregon,” March (received March 16<sup>th</sup>), a report prepared for NW Natural.



- Does not accept the Revised Interim Design Report as a 100% design document (i.e., a construction-ready submittal); and
- Approves NW Natural moving forward with the final groundwater SCMs design process for the Fill WBZ interceptor trench and the Alluvium WBZ HC&C system along shoreline segments 1 and 2.

The next step in the final groundwater SCMs design process is for NW Natural to prepare and submit the Draft Final Groundwater SCMs Design for DEQ review and approval that: 1) incorporates the groundwater SCMs design information, evaluations, and modifications indicated by DEQ; and 2) responds to U.S. Environmental Protection Agency (EPA) and DEQ comments.

DEQ's approval for NW Natural to move forward with the final groundwater SCMs design process is subject to our general and specific comments included in and/or attached to this letter. This letter also summarizes the status of source control along the shoreline of the NW Natural Property and the northern portion of the Siltronic Property, and provides an overview of the SCMs evaluation, planning, and design process.

## **SOURCE CONTROL STATUS**

DEQ determined the shoreline of the NW Natural Property and the northern portion of the Siltronic Property are high priorities for source control. The portion of the shoreline identified as the highest priority for source control (Segment 1) extends from near the south side of the Fuel and Marine Marketing (FAMM) leasehold on the NW Natural Property, to upstream of the former "Gasco Facility" manufactured gas plant (MGP) effluent ponds on the Siltronic Property. Segment 1 coincides with the heaviest MGP-related impacts identified near the river, including DNAPLs, contaminated groundwater, and impacted riverbank soils. It also includes the portion of the Siltronic Property where releases of chlorinated volatile organic compounds (cVOCs) from Siltronic's former solvent underground storage tank system have commingled with DNAPLs and groundwater contamination resulting from the historic operations of the Gasco Facility.

The segment of NW Natural's shoreline extending north of Segment 1 to the downstream property line with US Moorings (Segment 2) is also considered a high priority for source control, primarily due to the presence and concentrations of MGP chemicals of interest (COI), particularly cyanide, in riverbank soils and groundwater. A third shoreline segment (Segment 3) extends from upstream of the former effluent ponds to the upstream Siltronic Property line. A source control evaluation of Segment 3 is ongoing.

## **SOURCE CONTROL MEASURES PLANNING AND DESIGN PROCESS**

### **Groundwater and Dense Non-aqueous Phase Liquids Focused Feasibility Study**

NW Natural completed the Groundwater/DNAPL Focused Feasibility Study (FFS) for Segment 1 and Segment 2 in November 2007<sup>2</sup>. The Groundwater/DNAPL FFS presents the remedial action objectives (RAOs) for source control, which were jointly developed by NW Natural and DEQ including: 1) preventing DNAPL in the uplands from migrating to the Willamette River (RAO #1); and 2) hydraulic capture of upland groundwater discharging to the river (RAO #2). The Groundwater/DNAPL FFS also presents NW Natural's evaluation of SCMs alternatives and recommended SCMs to achieve RAOs. NW Natural's recommendation combined an HC&C system along shoreline segments 1 and 2 with a vertical barrier along the northern portion Segment 1 (i.e., the southern portion of the NW Natural Property where DNAPL occurs along the shoreline). DEQ approved NW

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<sup>2</sup> Anchor QEA, LLC, 2007, "Groundwater/DNAPL Source Control Focused Feasibility Study – NW Natural 'Gasco' Site," received October 12 (amended November 9, 2007), a report prepared for NW Natural.

Natural's recommendation subject to conditions and comments detailed in a March 21, 2008 letter which included, but are not limited to the following:

- Adding "shallow" extraction wells above the bottom of the vertical barrier with the objective increasing horizontal and upward vertical gradients operating behind the barrier, and reducing the potential for DNAPL to migrate below and beyond the influence of deeper extraction wells;
- Constructing engineering controls in the fill water WBZ on the upland side of the barrier to prevent DNAPL and/or contaminated groundwater from moving over or around the vertical barrier;
- Absent information, data, and/or analysis indicating the Alluvium WBZ extraction wells will control/contain groundwater in the Fill WBZ, DEQ expected evaluations of riverbank remedial alternatives to include this as an RAO<sup>3</sup>; and
- Including DNAPL removal as a SCM to the extent necessary to control and contain the potential movement of DNAPL from former effluent ponds on the NW Natural and Siltronic properties that could result from operation of the HC&C system.

The March 21<sup>st</sup> Letter should be referred to for additional information and details regarding the elements of source control carried forward into planning and design.

Subsequent to completion of the Groundwater/DNAPL FFS, NW Natural and DEQ participated in a series of planning meetings to work through the more substantive issues identified in the March 21<sup>st</sup> letter and establish the SCMs design process, including identifying and agreeing on "preliminary," "interim," and "final" design steps. Preliminary design steps included conducting studies to further assess the feasibility of constructing major elements of source control (e.g., vibration study in support of the vertical barrier; groundwater treatability study and treatment system pilot study to support evaluations of HC&C).

### **Preliminary Source Control Measures Design**

The Preliminary Design Report<sup>4</sup> prepared by NW Natural summarizes the status of SCMs planning and design based on the outcomes of the planning meetings. In addition, the document summarizes agreements reached by NW Natural and DEQ regarding SCMs design, the preliminary design for the principal source control elements, and those aspects of source control requiring further investigation so informed decisions could be made regarding sequencing SCMs implementation (e.g., DNAPL mobility evaluation). DEQ provided comments to the Preliminary Design Report in a letter dated August 22, 2008. DEQ's expectations regarding the content of the next SCMs planning document (the "Interim Design Report") were also communicated in the August 22<sup>nd</sup> Letter. In addition, DEQ's letter dated September 24, 2009 further clarified the content and elements of groundwater source control to be included of the Interim Design Report.

### **Interim Source Control Measures Design**

The Interim Design Report<sup>5</sup> represented the first source control document to incorporate the findings and results of SCMs design support and feasibility studies. Based on the outcome of planning meetings and support studies,

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<sup>3</sup> The Groundwater/DNAPL FFS included the riverbank in the uplands source control project and subject to DEQ oversight. Although the riverbank is now included in the Gasco Sediments Cleanup Action under EPA authority, controlling and containing groundwater in the Fill WBZ remains a high priority objective for uplands source control.

<sup>4</sup> Anchor QEA, LLC, 2008, "Preliminary Design Report – Groundwater Source Control, NW Natural Gasco Site," June, a report prepared for NW Natural.

<sup>5</sup> Anchor QEA, LLC, 2009, "Groundwater Source Control Interim Design Report – NW Natural Gasco Site," November (received November 10<sup>th</sup>), a report prepared for NW Natural.

the Interim Design Report confirmed the feasibility of NW Natural's SCMs alternatives recommendations made in the Groundwater/DNAPL FFS, and provides the interim design for a combination of SCMs, including a:

- Vertical barrier constructed of sheet piles extending from just north of the Siltronic property line to the south side of the FAMM leasehold; and
- HC&C system consisting of a series of ten extraction wells in the Alluvium WBZ along shoreline segments 1 and 2, including a groundwater treatment system sized to treat up to 400 gallons per minute (gpm).

In addition, the Interim Design Report provides NW natural's recommendations for modifying the SCMs final design and implementation by:

- Constructing the HC&C system, including the groundwater treatment system as soon as practicable after finalizing the design and obtaining necessary permits; and
- Further evaluating the vertical barrier and DNAPL removal SCMs in the uplands feasibility study (FS).

The reasons NW Natural gave for modifying recommendations made in the Groundwater/DNAPL FFS and proposing the vertical barrier and DNAPL removal SCMs be evaluated in the uplands FS included the following:

- The uplands FS could identify alternative technologies, or combinations of technologies, including DNAPL removal, soil removal, alternative configurations of vertical barriers, that would be more effective at achieving RAO #1 than the vertical barrier identified in the Interim Design Report;
- Evaluating the vertical barrier during the uplands FS would allow it to be considered in the context of a site-wide remedial action strategy; and
- Postponing the vertical barrier would facilitate development of more fully integrated upland and in-water sediment remedial actions.

DEQ provided comments on the Interim Design Report via a letter dated March 26, 2010. The March 26<sup>th</sup> letter provided DEQ's concurrence with NW Natural's recommendation to defer further evaluation and/or design of the vertical barrier and DNAPL removal SCMs to the uplands FS<sup>6</sup>. In addition, the March 26<sup>th</sup> letter provides DEQ's determination that the HC&C system along the portion of Segment 1 where DNAPL occurs should be evaluated together with the vertical barrier and DNAPL removal in the uplands FS. DEQ's decision on the HC&C system was made for a number of reasons, including but not limited to, the reliance of the source control planning and design process on combining SCMs to prevent DNAPL (vertical barrier) and contaminated groundwater (HC&C system) from migrating to the river; concerns that operating the HC&C system alone could exacerbate DNAPL occurrence; and the absence of shallow extraction wells in the interim HC&C system design. That said, DEQ approved groundwater source control for approximately 1250-1350 feet of the two shoreline segments, which together represent about 2,000 feet of shoreline (i.e., DEQ approved or conditionally approved the Alluvium WBZ HC&C system along the southern portion of Segment 1 on the Siltronic Property and all of Segment 2).

### **Source Control Measures Dispute**

After issuing the March 26, 2010 letter and meetings in April and May 2010 to discuss DEQ's source control decision, DEQ directed NW Natural to defer evaluation of the HC&C system and DNAPL SCMs for the portion of Segment 1 where DNAPL occurs (i.e., the vertical barrier alignment) to the uplands FS. DEQ's direction was communicated via a June 11, 2010 e-mail. NW Natural formally requested dispute resolution regarding DEQ's decision in an e-mail on July 14, 2010. Between July and December 2010, NW Natural and DEQ corresponded and convened meetings attempting to resolve the dispute. NW Natural provides many of the dispute-related

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<sup>6</sup> DEQ previously approved sequencing DNAPL removal SCMs after the vertical barrier, groundwater, and riverbank SCMs in a letter dated June 9, 2009.

documents in Appendix B. As indicated by DEQ in the attached specific comments, additional correspondence should be included in Appendix B for completeness.

The dispute was settled in December 2010 when NW Natural accepted DEQ's proposal to modify our June 11<sup>th</sup> direction. DEQ modified the June 11<sup>th</sup> direction by providing NW Natural the opportunity to redesign the HC&C system along the disputed portion of Segment 1 and present the redesign in the final source control design document instead of deferring it to the uplands FS.

DEQ's proposal was contingent on the following conditions being met prior to NW Natural submitting the final design document.

1. Resolution of remaining design details related specifically to the HC&C system raised in DEQ's March 26, 2010 letter commenting on the Interim Design Report, concerns discussed during the May 17, 2010 technical meeting, and key issues identified by DEQ during a February 3, 2011 meeting.
2. Agreement on a performance monitoring program to determine HC&C system performance & effectiveness through monitoring the system's hydraulic influence, trends in groundwater data, and DNAPL movement. Regarding DNAPL movement, NW Natural agreed that if observations indicate significant migration is occurring; DEQ may require additional interim action(s), and if significant migration is not observed, NW Natural will fully address DNAPL management in the upland FS.
3. Development of a path forward to complete the human health and ecological risk assessment (Risk Assessment). NW Natural and DEQ mutually agreed completing the Risk Assessment is needed in order to expedite development of the upland FS. Achieving this objective will minimize the amount of time the HC&C system operates prior to construction of the final uplands remedy, including DNAPL management.

The conditions listed above were worked out between NW Natural and DEQ during a meeting on December 13, 2010 and by e-mails exchanged on December 15<sup>th</sup>, December 17<sup>th</sup>, December 22<sup>nd</sup>, and January 3, 2011.

DEQ believes it is important to note that settlement of dispute resolution left certain dispute documents open. For example, to date DEQ has not replied to NW Natural's November 29, 2010 point-by-point response to our August 29, 2010 letter. In the interest of moving source control forward, DEQ has elected not to reply at this time. This should not be interpreted by NW Natural as DEQ's acceptance of the November 29<sup>th</sup> letter. For clarification, DEQ disagrees with NW Natural's responses to many of our comments and assertions. DEQ may choose to reply to the November 29<sup>th</sup> letter at a later date.

### **Groundwater Source Control Measures Design**

Subsequent to resolving the dispute, DEQ identified the key issues for groundwater source control planning and design in an agenda prepared for a February 3, 2011 meeting. The key issues included the following:

- Incorporating the Fill WBZ into the source control planning and design process;
- Finalizing the design of the HC&C system along the southern portion of shoreline Segment 1 (i.e., on the Siltronic property upstream of DNAPL occurrence) and along Segment 2;
- Evaluating the re-design concept for the HC&C system along the portion of Segment 1 where DNAPL occurs, including:
  - Any information, data, and/or data analysis needed to support planning and design of the HC&C system
  - Design and operational criteria to minimize potential DNAPL migration caused by the HC&C system
  - Objectives and approach to monitoring the horizontal and vertical movement of DNAPL resulting from pumping extraction wells, including establishing baseline conditions
- Completing and submitting the treatment system NPDES application;

- Coordinating source control design and FS planning and scoping in the former Tar Ponds areas;
- Sequencing source control implementation and the final remedy in the former Tar Ponds areas.

NW Natural prepared the Revised Interim Design Report after the February 3rd meeting. The Revised Interim Design Report presents NW Natural's SCMs design for the principal elements of groundwater source control along shoreline segments 1 and 2, including; 1) a proposed design for controlling and containing groundwater in the Fill WBZ; 2) redesigning the Alluvium WBZ HC&C system along the portion of Segment 1 where DNAPL occurs; 3) a groundwater and DNAPL performance monitoring plan for the Alluvium WBZ HC&C system; and 4) a water treatment system.

DEQ reviewed the Revised Interim Design Report in the context of the dispute resolution settlement conditions and the key issues for source control discussed during the February 3<sup>rd</sup> meeting. Based on DEQ's review, the Revised Interim Design Report:

- Addresses the key issues of incorporating the Fill WBZ into the source control planning and design process by proposing an interceptor trench across segments 1 and 2, and submitting the NPDES application for the treatment system.
- Along with the Segment 2 Test Plan Report and DEQ's comments, identifies information needed to finalize the design of the HC&C system on the Siltronic Property and along Segment 2 including, evaluating: 1) extraction well designs, 2) the need for additional upper Alluvium WBZ extraction wells at the PW-09 (PW-09U) and PW-10 location (PW-10U), and 3) the long-term operational capacity of the HC&C system.
- Does not address the key issues related to redesigning the HC&C system along the portion of Segment 1 where DNAPL occurs.

Regarding the last two bulleted items, given source control design is ongoing and the uplands FS has not been initiated, DEQ believes a reasonable goal for coordinating source control design and FS planning is to complete the Risk Assessment and final SCMs design within a similar timeframe. NW Natural should discuss sequencing and implementation of groundwater SCMs with the final remedy in the Draft Final Groundwater SCMs Design, especially with regard to the former Tar Ponds area. Currently, DEQ understands NW Natural will be developing a comprehensive upland DNAPL management evaluation in the uplands FS.

## **GENERAL COMMENTS**

DEQ's general comments on the Revised Interim Design Report are provided below. The general comments are intended to clarify the RAOs for groundwater source control and the SCMs design information, evaluations, and modifications NW Natural needs to provide to address the key issues for redesigning the HC&C system along the portion of Segment 1 where DNAPL occurs. DEQ's specific comments on the Revised Interim Design Report are attached. Besides DEQ, the EPA and the U.S. Army Corps of Engineers (ACOE) reviewed the Revised Interim Design Report. The EPA's comments are attached, and a copy of the ACOE's comments is also provided. NW Natural should note, EPA and DEQ share many comments. As such, NW Natural should closely review the attachments so all comments are considered during preparation of the Draft Final Groundwater SCMs Design. DEQ understands NW Natural proposes the Alluvium WBZ HC&C system as an element of the in-water sediment project. Based on this understanding DEQ believes EPA's June 29, 2011 comments are directly applicable to the Revised Interim Design Report. In addition to the reviews completed by the ACOE, EPA, and DEQ, and given the Revised Interim Design Report includes the northern portion of the Siltronic Property, DEQ understands Siltronic provided NW Natural with comments which were fully incorporated into the document prior to its being issued to DEQ.

## **Groundwater SCMs Remedial Action Objectives**

The source control RAOs listed in Section 1.2 reflect the Groundwater/DNAPL FFS and DEQ's March 21, 2008 comments on the same. The RAOs included in the Groundwater/DNAPL FFS, as modified by DEQ's March 21<sup>st</sup> letter do not directly apply to the source control planning and design process which came out of the dispute resolution settlement. The focus of source control is now on the groundwater pathway. The RAOs for groundwater source control are to prevent migration of contaminated groundwater from the uplands to the Willamette River along shoreline segments 1 and 2 in a manner that minimizes DNAPL mobilization resulting from groundwater SCMs along the portion of Segment 1 where DNAPLs occurs.

In the first paragraph at the top of page 3, NW Natural implies the performance monitoring plan in the Revised Interim Design Report addresses DNAPL migration to the river. This is not the case. The performance monitoring program is intended to evaluate HC&C system performance through monitoring its hydraulic influence, trends in groundwater data, and DNAPL movement. As discussed above, further evaluation and design of the vertical barrier (i.e., the DNAPL SCM intended physically prevent DNAPL from migrating to the river) has been deferred to the uplands FS. Consistent with DEQ's determination documented in the March 26, 2010 commenting on the Interim Design Report and agreements reached during dispute resolution, NW Natural will carry the vertical barrier<sup>7</sup> forward into detailed analysis in the uplands FS as a remedial action alternative for RAO #1. DEQ's March 26<sup>th</sup> should be referred to for additional information on the status of the vertical barrier.

NW Natural should revise the RAOs in the Draft Final Groundwater SCMs Design consistent with these comments.

## **Long-term Operation and Effectiveness of the Hydraulic Control and Containment System**

The Alluvium WBZ SCM is a well-based HC&C system designed to reverse hydraulic gradients from the river towards the uplands. According to NW Natural gradient reversals will be achieved using a Programmable Logic Control (PLC) that monitors the gradient differential between uplands groundwater and the river at selected control wells. Each extraction well will be equipped with variable frequency drive (VFD) pump which is interfaced with the PLC to change the pump speed and pumping rate concurrently with groundwater elevation changes caused by river stage fluctuations.

DEQ believes the long-term effectiveness of the Alluvium WBZ SCM is dependent on:

- The capacity of the HC&C system to continuously pump groundwater on a year-round basis at the rates required to achieve and maintain gradient reversals in the Alluvium WBZ to prevent contaminated groundwater in the uplands along segments 1 and 2 down to the top of the CRB from migrating to the Willamette River; and
- Minimizing the potential for DNAPL migration to occur as a result of operating the HC&C system along the portion of Segment 1 where DNAPL occurs.

The Revised Interim Design Report does not include contingencies. Given this information and the size, cost, and performance/effectiveness objectives of the HC&C system, factors that could limit the system's pumping capacity should be identified, fully evaluated, and addressed before finalizing the groundwater SCMs design. Based on review of the Revised Interim Design Report and the results of the Segment 2 pilot extraction well

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<sup>7</sup> The vertical barrier to be carried into detailed analysis in the uplands FS will be 625 feet long with a bottom depth corresponding to -60 feet City of Portland datum and constructed using sheet-pile methods.

tests, the potential affect of the following factors on the long-term effectiveness of the HC&C system should be further evaluated:

- NW Natural's presumption that groundwater level changes and gradient changes observed between pre-pumping and pumping periods during Segment 2 pilot well tests are due entirely to the influence of extraction wells (e.g., influence of river stage fluctuations are considered negligible), which could lead to overestimating the effectiveness of the HC&C during times of the year;
- Data from the Segment 2 PLC and VFD field tests that suggest the total extraction rate of the HC&C system may be greater than 260 gpm determined from numerical simulations, including;
  - Projected groundwater inflows into the lower Alluvium WBZ and upper Alluvium WBZ of 305 gpm (upper Alluvium WBZ) and 650 gpm (lower Alluvium WBZ) above the aquitard, implying individual upper Alluvium WBZ extraction wells need to sustain an average pumping rate of 30.5 gpm, and each extraction well in the lower Alluvium WBZ must pump at an average rate of 65 gpm.
  - The average pumping rates for lower Alluvium WBZ extraction wells PW-7-93, PW-8-68, and PW-9-92 equipped with VFDs was 50 gpm, 67 gpm, and 34 gpm during a 72-hour pumping period.
  - Groundwater level data from certain uplands monitoring wells constructed in the lower Alluvium WBZ which showed little response during pilot extraction well testing (e.g, MW-21-116).
- The potentiometric surface of the Alluvium WBZ which seasonally occurs near the base of the fill unit (i.e., top of the upper silt unit); and
- Heterogeneity of the upper Alluvium WBZ and extraction well design factors that could contribute to excessive drawdown in extraction wells during HC&C operation.

DEQ believes the factors listed above would have a maximum negative impact on the operation and performance of upper Alluvium WBZ extraction wells. The Draft Final Groundwater SCMs Design should fully evaluate these factors by:

- Using the MODFLOW model updated to include the results of Segment 2 pilot extraction well tests, to simulate HC&C system operation under seasonal operating extremes of groundwater levels and river stage. The results of the simulation should be evaluated in terms of the available drawdown for each extraction well included in the Revised Interim Design Report. The pump placement elevation(s) implied by the schematic design drawings provided in the revised interim SCMs design (see figures 3-7a and 3-7b) should also be utilized in the evaluation. The specific capacities determined for existing extraction wells should be incorporated into the evaluation for purposes of comparison.
- Reevaluating extraction well designs, including screen radius, length, depth of placement, slot-size, and filter-pack gradations of existing extraction wells in the context of what is now known about the material properties of the upper Alluvium WBZ. Well efficiencies determined from the pumping tests completed at the site to date should be used in the evaluations. In addition, the designs of the proposed extraction wells should be based on location-specific information (e.g., sieve analyses collected during drilling from the depth interval of screen placement at each extraction well location).

The results of transient MODFLOW simulations and the extraction well design evaluation(s) should be included in the Draft Final Groundwater SCMs Design. The simulations and well design evaluations might identify operational scenarios which could prompt modifications to the HC&C system (e.g., addition of extraction wells). The draft final SCMs design document should discuss these scenarios in terms of potential future contingency measures.

DEQ's request for transient groundwater simulations made here is consistent with the March 26, 2010 letter which indicates the HC&C system, "...will need to accommodate a dynamic system influenced by seasonal changes in natural recharge, river stages and tidal influence," and recommends that, "...NW Natural run the



MODFLOW model in a transient state to verify the model's ability to simulate changing groundwater flux and hydraulic head conditions resulting from these influences." Furthermore, DEQ's January 11, 2010 letter commenting on the Segment 2 Test Plan informs NW Natural that, "...final data interpretations, conclusions, and analysis, including the results of numerical modeling, should be fully integrated in the HC&C system final design."

**Uplands Source Control and the In-water Sediment Remedy.** Groundwater SCMs are being designed to prevent migration of contaminated groundwater from the uplands to the Willamette River by controlling and containing groundwater in the Fill WBZ and Alluvium WBZ. In addition, NW Natural proposes the Fill WBZ and Alluvium WBZ SCMs as elements of the in-water sediment remedy being overseen by EPA. The Revised Interim Design Report does not discuss how the long-term sediment remedy objective of achieving and maintaining gradient reversals under the river will be reconciled with the source control objective of minimizing DNAPL movement. The Draft Final Groundwater SCMs Design should discuss this scenario fully, including the operational priorities of the HC&C system in the context of the in-water remedy. For example, in the absence of an in-water remedy, the operational and performance objectives of the HC&C system are dictated by uplands groundwater source control. NW Natural should discuss how the operational objectives of the system might change during and after implementation of the in-water remedy. NW Natural should note that DEQ's comment regarding the long-term operation/effectiveness of the HC&C system applies here as achieving gradient reversals for the in-water project would require greater extraction rates than for source control alone.

## **Performance Monitoring**

**Monitoring Well Network.** NW Natural indicates, "The network of existing shoreline monitoring wells was carefully evaluated to determine which wells have suitable location and screen elevation to be useful to assess the capture performance of the extraction well system." Table 3-4 identifies the installations NW Natural believes are necessary to assess capture for the entire HC&C system, including whether they will serve as groundwater elevation data measuring points or control wells for HC&C system operation; and the current and proposed schedule for collecting groundwater samples for analysis.

DEQ does not approve sections 3.2.2.5.1 and 3.2.2.5.2 of the revised interim design as there is no discussion of the data collection objectives for the performance monitoring well network or the criteria NW Natural proposes to use to "assess capture performance of the extraction well system." These sections should be revised to:

- Provide clear descriptions of the data collections objectives of the performance monitoring well network;
- Discuss the piezometers, observations wells, and monitoring wells in the proposed performance monitoring well network in terms of the data collection objectives;
- Identify the specific data collection objectives of each well;
- Propose criteria for assessing the performance and effectiveness of the HC&C system and making adjustments to system operations.

Based on our review of this section and figures 2-3b and 2-3c, DEQ also determines: 1) monitoring wells MW-4-57 and MW-17-79 are not appropriate to use as control wells as they are located too close to extraction wells, or are not constructed appropriately (i.e., MW-17-79 has a screen 40-feet long); and 2) there are no installations proposed to monitor the influence of the HC&C system in the lower portion of the upper Alluvium WBZ along the portion of Segment 1 where DNAPL occurs. As such, the monitoring well network should be modified to include:

- Abandonment and replacement of monitoring well MW-17-79 with a control well constructed in the upper portion of the upper Alluvium WBZ and located approximately halfway between extraction wells PW-5U and PW-13U;
- Installation of a control well in the upper Alluvium WBZ between extraction wells PW-5U and PW-14U; and
- Construction of monitoring wells in the lower portion of the upper Alluvium WBZ at the PW-11U, PW-12U, PW-13U, and PW-14U extraction well locations.

The additional monitoring wells should be equipped with transducers. The revisions and modifications listed above should be incorporated into the Draft Final Groundwater SCMs Design. DEQ's comments and expectations regarding the specific aspects of NW Natural's proposed groundwater monitoring program for extraction wells, monitoring wells, observation wells, and piezometers are attached (see DEQ's comments to Section 3.2.2.5.4 [Water Quality Trend Monitoring]).

**DNAPL Monitoring.** DEQ approves the portions of Section 3.2.2.5.3 regarding "Monitoring and Recovery of DNAPL Entering Wells," "Monitoring of the Oil-Water Separators," and DNAPL Monitoring Reporting" subject to the specific comments attached. DEQ does not approve the portion of the section discussing "DNAPL Sampling" for the following reasons.

- Consistent with requests made by DEQ in letters dated August 22, 2008 and March 26, 2010, and during meetings on February 3<sup>rd</sup> and March 3, 2011, NW Natural should revise geologic cross-sections to show locations near the shoreline where there is evidence of DNAPL occurrence (see DEQ's specific comment to Section 3.2.1.6, 4<sup>th</sup> paragraph);
- Although the general rationale for redesigning the portion of the Segment 1 HC&C system is provided in Section 3.2.2.2.1, operational parameters and performance criteria for achieving and maintaining HC&C of the Alluvium WBZ and assessing and minimizing potential DNAPL movement are not presented in the Revised Interim Design Report; and
- The proposed Targost® sampling approach does not adequately assess lateral DNAPL migration, and does not propose to assess vertical DNAPL movement in the vicinity of extraction wells where the potential for movement in response to HC&C system operation is the greatest.

To address each of these items, NW Natural should:

- Fully respond to DEQ's comments made to the fourth paragraph of Section 3.2.1.6, by revising figures 2-3b and 2-3c, figures 2-5 through 2-8, and figures 3-8 and 3-9;
- Develop HC&C operational parameters (e.g., placing upper limits on extraction well pumping rates) and performance criteria (e.g., ranges of horizontal and vertical hydraulic gradient values in the Alluvium WBZ within which DNAPL mobilization is minimized) to achieve hydraulic containment but not exceed conditions that could mobilize DNAPL; and
- In addition to sampling areas 1, 2, and 3, NW Natural should use available information from groundwater modeling, and geologic cross-sections of the alluvium and DNAPL occurrence to determine where the potential for horizontal and/or vertical DNAPL migration is relatively high and target those areas for Targost® monitoring (e.g., below PW-6U; adjacent to and below PW-3-85; adjacent to PW-2L; adjacent to PW-14U).

DEQ expects these revisions to the interim design to be included in the DNAPL monitoring section of the Draft Final Groundwater SCMs Design.

### **Interceptor Trench Length, Alignment and Construction Sequence, Flow Rates, and Limitations on Uplands SCMs or Riverbank Alternatives**

The Revised Interim Design Report is the first design document that presents an approach for controlling and containing groundwater in the Fill WBZ along shoreline segments 1 and 2. In general, DEQ accepts NW Natural's approach to controlling and containing groundwater in the Fill WBZ using a fully-penetrating interceptor trench. However, DEQ does not approve the interceptor trench design and has numerous comments regarding the recommended length, alignment, sequence and schedule for construction, estimated flow rates, and potential for the trench to interfere with other uplands SCMs. The Draft Final Groundwater SCMs Design document should include information to address each item.

**Length.** The interceptor trench runs roughly parallel to the shoreline of segments 1 and 2, ending in the northern corner of NW Natural's property. However, the ACOE's remedial investigation found evidence of MGP contamination in soil and groundwater on the U.S. Moorings associated with the "former northern spent oxide/gas purifier waste storage pile" (spent oxide pile). Work completed by NW Natural documents soil and groundwater contamination associated with the spent oxide pile in the uplands and offshore of the northern portion of the NW Natural Property. The spent oxide pile was formerly located immediately adjacent to, and along the property line between the NW Natural and ACOE properties.

As indicated in DEQ's March 10, 2010 letter commenting on the RI Report and Risk Assessment, NW Natural should conduct additional soil and groundwater investigations in the northern portion of the NW Natural Property to: 1) delineate the nature and extent of MGP contamination in soil and groundwater; 2) evaluate the occurrence and direction(s) of groundwater flow in the Fill WBZ and Alluvium WBZ; and 3) characterize the concentrations of MGP COI in soil and groundwater migrating from the NW Natural to offsite areas, including the U.S. Moorings site.

The scope of work for these investigations should include drilling and installation of monitoring wells in the Fill WBZ and Alluvium WBZ. Based on the data collected by the ACOE and NW Natural, the results of this work could indicate contaminated groundwater is migrating offsite to the north and discharging to the river via the U.S. Moorings site. As such, groundwater sampling in the northern portion of the NW Natural's property could influence the groundwater SCMs design along shoreline Segment 2 (e.g., result in lengthening the interceptor trench; the addition of extraction wells in the Alluvium WBZ). NW Natural should fully discuss the scenario involving the U.S. Mooring site in the context of the groundwater SCMs design for the fill and Alluvium WBZ and the sequence and timeframe for conducting the additional soil and groundwater investigations.

In addition to the U.S. Mooring site, groundwater data for the Fill WBZ collected at the WS-8 well cluster indicates the length of the interceptor trench should be extended to near the southern end of Segment 1. Extension of the trench should be further evaluated and discussed in the Draft Final Groundwater SCMs Design.

**Alignment and Sequence.** The Revised Interim Design Report recommends constructing the Fill WBZ interceptor trench concurrently with the riverbank cleanup included in the in-water sediment remedy. DEQ understands the primary justification for the recommendation is the presence of shoreline structures, including the FAMM tank farm, FAMM office, Siltronic's outfall, and docking and mooring structures. NW Natural indicates that in these areas, "...the trench will be constructed at the top of the riverbank or partially on the riverbank slope due to the presence of the shoreline structures."

Although DEQ acknowledges shoreline structures and facilities present difficulties with regard to access and construction, we disagree with NW Natural's recommended alignment and construction sequence for the following reasons:

- Postponing constructing the trench until sometime after the in-water project is initiated will significantly delay source control of the Fill WBZ. Constructing the trench before the riverbank project is initiated will achieve source control in the Fill WBZ years earlier for most of shoreline segments 1 and 2.
- Shoreline interferences are primarily associated with the FAMM leasehold. The FAMM leasehold represents approximately 600-feet of about 2,000-feet of shoreline. Upstream and downstream of the leasehold there appears to be working room. As such, it appears approximately 1,400-feet of trench does not have significant access and/or construction restrictions. Furthermore, the accessible 1,400-feet of trench alignment roughly coincide with the most significant contamination in the Fill WBZ near the shoreline.
- Setting the trench back from the top-of-bank will reduce uncertainty regarding slope stability and intercept contaminated groundwater further upgradient of the river. Locating the trench on the uplands side of the extraction wells would also allow for performance/effectiveness monitoring using existing and proposed Fill WBZ monitoring wells.
- Where mobile DNAPL occurs along the alignment, construction of the trench will promote DNAPL movement into the trench. Placing the trench near or on the riverbank could induce DNAPL movement towards the riverbank following NW Natural's recommendation. Aligning the trench near the extraction wells will induce DNAPL movement away from the riverbank and remove DNAPL from the fill in areas where downward vertical gradients between the Fill WBZ and Alluvium WBZ are greatest (i.e., above extraction wells).

Except for the section along the FAMM leasehold, NW Natural should reevaluate the alignment, sequence, and schedule to construct most of the trench in the same timeframe and along a similar alignment as the HC&C system.

**Flow Rates.** NW Natural indicates the Alluvium WBZ HC&C system is a higher priority for implementation than the interceptor trench based largely on NW Natural's expectation that flow rates from the Fill WBZ will be less than 10% of the Alluvium WBZ (i.e., the Alluvium WBZ HC&C system will intercept more than 90% of the contaminated groundwater migrating to the river).

Information available in the RI Report suggests NW Natural's estimate may be low. The RI Report indicates that during 2005, on an average daily basis 20,000 gallons of storm water and contaminated groundwater from the Fill WBZ were pumped out of the LNG tank basin, treated using granulated activated carbon, and discharged to the City of Portland publically-owned treatment works (POTW). The average daily removal rate corresponds to approximately 15 gpm. DEQ acknowledges the removal rate includes storm water, but notes the bottom of the LNG Basin is typically 2 to 7 feet below the water table in the Fill WBZ. Furthermore, the LNG Tank basin intercepts only a portion of the total groundwater moving through the Fill WBZ towards the river. Based on the information above and the magnitude of contamination in the surficial fill near the river, NW Natural should fully document estimates of groundwater flux through the Fill WBZ, including the magnitude and timing of seasonal extremes for purposes of verifying the anticipated total flow rate of 20 gpm.

**Potential Limitations on Uplands SCMs and/or Riverbank Alternatives.** As DEQ indicated in the March 21, 2008 letter regarding the Groundwater/DNAPL FFS, planning, design, and implementation of the uplands SCMs must take into consideration future riverbank work, including but not limited to bank repair, stabilization, and/or excavation, removal, and replacement. DEQ continues to maintain construction of the riverbank remedy should not interfere with the uplands SCMs, which now includes the Fill WBZ interceptor trench, the Alluvium WBZ HC&C system, and the treatment system and its associated equipment, buildings, and piping. Likewise, uplands

SCMs should not limit NW Natural's ability to implement effective remedial alternatives to address the riverbank. Implementation of groundwater SCMs should satisfy two conditions: 1) the interceptor trench and HC&C system should preserve maximum flexibility in accommodating the range of options for remediating bank soil and river sediment, and 2) future riverbank work should not interfere with construction of groundwater SCMs or compromise groundwater SCMs during riverbank sediment remedy construction.

### **Treatment System Building Locations and Treated Water Discharge**

**Locations.** The treatment system and pre-treatment system buildings are located within former Gasco Facility lampblack and/or effluent ponds waste management areas. The soils underlying these former MGP waste management areas exceed human health and ecological risk-based criteria. Furthermore, NW Natural and DEQ agree that the former effluent ponds waste management area (i.e., the Tar Ponds area) represents a hot spot of contamination for soil and groundwater.

Contamination underlying the treatment and pre-treatment building locations is not discussed in the Revised Interim Design Report. The Draft Final Groundwater SCMs Design should provide a development plan that addresses contamination during treatment building and pre-treatment building site preparation and construction. The building locations should also be discussed in terms of uplands final remedial action alternatives (e.g., potential to interfere with, or an element of remedial alternatives. Alternatively, NW Natural could consider relocating the buildings to an area(s) where the magnitude of soil contamination is less significant, the need for site preparations is reduced, and the potential to interfere with final remedial actions is less.

**Treated Water Discharge.** The approach for discharging treated water to the Willamette River is an important component for the SCMs design and NPDES permit application. The Revised Interim Design Report does not provide information on NW Natural's approach. Based on an e-mail sent by NW Natural on August 29, 2011, DEQ understands the approach will involve discharging treated water to the river via piping which will require additional information to supplement the SCMs design and NPDES permit application. NW Natural should be advised additional state and/or federal permits could be required for the outfall.

### **NEXT STEPS**

NW Natural should prepare and submit the Draft Final Groundwater SCMs Design by: 1) incorporating the supplemental SCMs design information, evaluations, and modifications requested by DEQ; and 2) responding to EPA's and DEQ's comments. The Draft Final Groundwater SCMs Design and response to comments should be submitted to EPA and DEQ for review within 45 days of NW Natural's receipt of this letter.

Please feel free to contact me with questions regarding this letter and attachments.

Sincerely,

Dana Bayuk  
Project Manager  
Portland Harbor Section

Robert Wyatt  
NW Natural  
September 22, 2011  
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Attachments:           DEQ's "Specific Comments"  
                              EPA's Comments  
                              ACOE Letter

Cc:     Patty Dost, Pearl Legal Group  
          John Edwards, Anchor QEA  
          Ben Hung, Anchor QEA  
          Carl Stivers, Anchor QEA  
          Rob Ede, Hahn & Associates  
          Myron Burr, Siltronic Corporation  
          Tom McCue, Siltronic Corporation  
          Alan Gladstone, Davis Rothwell Earle and Xochihua  
          James Peale, Maul Foster & Alongi, Inc.  
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          Christine Budai, ACOE  
          Mark Ader, EPA  
          Chip Humphrey, EPA  
          Kristine Koch, EPA  
          Sean Sheldrake, EPA  
          Lance Peterson, CDM  
          Jim Anderson, NWR/PHS  
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          Tom Gainer, NWR/PHS  
          Henning Larsen, NWR/SRS  
          Matt McClincy, NWR/PHS  
          ECSI No. 84 File  
          ECSI No. 183 File